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Penaeid Shrimp—Their Biology and Management. *By John A. Gulland and Brian J. Rothschild. Fishing News Books Limited, Farnham, Surrey, England. 1984. 308 pages. £30.00 (paper).*

This report from the November 1981 Key West Workshop, which attracted shrimp experts from different corners of the globe, is divided into two parts. First are the excellent overview papers describing the shrimp fisheries of Australia, China, the Guianas and Brazil, India, Indonesia, Senegal, and the United States' Gulf of Mexico. Second are papers on the specifics of management and shrimp biology, including topics on methods of analysis, ecology, and environmental factors. Forty reports were given at the meeting, but only 19 papers were selected for inclusion in this extremely valuable report.

The overall aim of the workshop was to evaluate the scientific basis for management of penaeid shrimps throughout the world. Oddly, only 4 of the 45 participants were involved with management aspects of penaeid shrimp fisheries. As a result, the scientific point of view predominant throughout this report provides little insight to management needs and problems.

The experts agreed that most shrimp fisheries face similar problems and that shrimp management is somewhat different from that of most finfish fisheries because shrimp have a different life history and short life span. The stocks are generally fully exploited and there is little opportunity to increase catches; management problems revolve around allocation. Fishing effort is generally increasing and causing serious economic or social problems even though the specific stocks may not be in danger. The failure to identify the potential for changes in effective fishing effort can cause serious problems in short periods of time.

Failure to identify economic signals may be even more serious. Recognizing these problems, the general consensus was that most of the world shrimp stocks required some form of timely management, which would involve control of fishing effort and would probably, either directly or indirectly, affect the distribution of total effort. Maintenance of shrimp stocks was of increasing concern in that the precarious position of some stocks is masked by their high economic growth yield. No direct evidence, however, was given to support this opinion.

The workshop report is well written, clear, and contains a wealth of information. The problem does not arise with what is contained in the book, but what is lacking related to management of penaeid shrimps. The editors mention quite correctly that scientists in many countries are not prepared to provide managers with advice because of a lack of clearly defined management objectives. This report lacks information from managers concerning goals, objectives, information requirements, methods of implementation, enforcement, and adherence or acceptance by fishing sectors of regulations.

There is an apparent need, not widely discussed in this report, for "real-time" statistics. Because shrimp are basically an annual crop and shrimp populations can change quickly, managers require statistics on a much more frequent basis than for longer-lived fish. Rothschild and Brunemeister mention this in passing, yet little attention has been paid to the subject of statistics required by managers and scientists. The report also fails to recognize needs of managers for basic biological information and realistic models that can be effectively used in managing resources. The papers provide adequate warning about potential danger on the horizon, but do little to convey how we should provide scientific information to managers and to the industry. The report is also silent on how to gain acceptance by the industry for management before a drastic or catastrophic decline occurs.

Gulland notes that, until recently, the relationship between recruitment and the size of the spawning stock of shrimp has been neglected. The opinions expressed as to stock–recruitment relationships are varied and, for the most part, in opposition. Some authors show evidence that recruitment is driven by environmental conditions. Others indicate recruitment is driven by adult stock abundance. Further, many shrimp scientists have indicated that recruitment is independent of adult stock and that "average recruitment is the same at all sizes of spawning

stock." Apparently, justification for this assumption is that there have been no obvious cases of recruitment overfishing of shrimp stocks. Gulland goes on to point out, quite correctly, the difficulty in documenting stock–recruit relationships because of the problem of estimating the size of the standing stock. The existence of recruitment overfishing is usually only evident after collapse of, and at high economic loss to, the fishery.

It is clearly recognized that the concept of maximum sustainable yield is useful for management of penaeid shrimp fisheries. The majority of production models discussed in detail show relatively high levels of fishing effort and suggest that a reduction in effort would almost certainly lead to economic benefits to the fishery. Production models were shown to be effective for shrimp, a single-year-class fishery, and are probably easier to interpret than they are for the common multiple-year-class fisheries.

Several of the authors caution managers that maximum yields in any year should not be viewed as all the shrimp that can be caught. There are some indications of good stock–recruitment relationships and that certain fisheries actually may be in danger of recruitment overfishing (specifically, the brown shrimp fishery in the Gulf of Mexico). A common theme throughout the overview papers is that shrimp are probably being exploited at a smaller size than is ideal. Care should be taken to monitor the amount of small shrimp being harvested; an increase in yield could result from altering the present management strategies to harvest larger-size shrimp.

Various management measures that control fishing mortality, capacity, size at first harvest, and allocation among user groups are presented and discussed. A high rate of exploitation and growth overfishing are identified in many fisheries, and the possibility of recruitment overfishing is indicated in some of the fisheries. India's fishery has declined substantially from the 1973 high of 220,000 t. Indonesian fisheries have shown extreme competition in populated areas, and the government has implemented restrictions on the number of vessels. Bowen and Hancock reported on limited entry in Australian prawn fisheries and provide a system of preventing gross overcapacity and of improving the economic performance. The problem with overcapacity is not completely resolved, but new problems relate to increasing effectiveness of fishing effort and the difficulty of reducing this effort. Other problems relate to balancing fishing effort on different prawn species in the same area and the interaction between competing fisheries. The Australian prawn fisheries have management objectives that include biological, economic, and social factors. Measures taken include limited entry to control fishing effort and capital inflow, closed seasons, and closed areas to protect small shrimp.

A list of agreed areas for future research is presented, including stock–recruitment relations, natural mortality, standardization of fishing effort, habitat, updating and improving data bases, data integration, use of models, analysis of the system, and socioeconomics. This was all agreed to by scientists who are trying to provide this information to managers, but there was little word from the managers about the type of information needed day to day.

It appears that the modelers and scientists are able to develop wonderful schemes without considering how they could be practically adhered to and enforced. Adoption of scientific management principles by the public sector was not addressed. It appears we have not done our job in terms of education of the public sector, yet we have provided a wealth of information that is not being used to the maximum at the present time.

Gulland, in his short article at the end of the text, provides some insight into fishery management. Ten years ago he indicated that without controls, fishing would rapidly expand until benefits were dissipated by excess costs. Now it is apparent that many of the shrimp fisheries of the world are fully exploited at high levels of fishing effort. Few effective material management measures have been implemented (with the possible exception of the Australian fisheries, which have to some degree an effective control of fishing effort). Major shrimp fisheries are plagued by fully exploited resources and harvest of undersized shrimp. The scientists seem to know what needs to be done, but implementation of management suggestions still has a long way to go. Unless action is taken in the immediate future, the trend of increasing effort and no increase in catch will not reverse itself.

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